

JOSEPH J. GRAHAM
GEOLOGY DEPT.
STANFORD UNIVERSITY

CONTRIBUTIONS
FROM THE
CUSHMAN LABORATORY
FOR
FORAMINIFERAL RESEARCH

VOLUME 18, PART 3

SEPTEMBER, 1937

CONTENTS

	PAGE
No. 187. Notes on Some of the Early Described Eocene Species of Bulimina and Buliminella	65
No. 188. The Described American Eocene Species of <i>Uvigerina</i>	74

SHARON, MASSACHUSETTS, U. S. A.

1937

CUSHMAN LABORATORY
FOR FORAMINIFERAL RESEARCH
Brook Road, Sharon, Mass. U. S. A.

JOSEPH A. CUSHMAN, Ph. D., Director

ALICE E. CUSHMAN, Secretary, in charge of Publications

FRANCES L. PARKER, M. S., Research Assistant

PATRICIA G. EDWARDS, A. B., Illustrator and Secretary

ANN SHEPARD, Illustrator

These contributions will be issued quarterly. They will contain short papers with plates, describing new forms and other interesting notes on the general research work on the foraminifera being done on the group by the workers in this laboratory. New literature as it comes to hand will be briefly reviewed.

Subscription \$2.50 per year post paid.

Volume 1, April 1925—January 1926, (Reprinted, 1935).....	\$3.00
Volume 2, April 1926—January 1927, (Reprinted, 1935).....	\$3.00
Volume 3, part 1, March 1927 (With complete sets only).....	\$2.00
Volume 3, parts 2-4, June—December, 1927, (Reprinted, 1936) ..	\$2.00
Volume 4, parts 1-4, March—December, 1928, complete.....	\$2.50
Volume 5, parts 1-4, March—December, 1929, complete.....	\$2.50
Index to Volumes 1—5 inclusive.....	\$1.00
Volume 6, parts 1-4, March—December, 1930, complete	\$2.50
Volume 7, parts 1-4, March—December, 1931, complete	\$2.50
Volume 8, parts 1-4, March—December, 1932, complete.....	\$2.50
Volume 9, parts 1-4, March—December, 1933, complete.....	\$2.50
Volume 10, parts 1-4, March—December, 1934, complete.....	\$2.50
Index to Volumes 6—10 inclusive	\$1.00
Volume 11, parts 1-4, March—December, 1935, complete	\$2.50
Volume 12, parts 1-4, March—December, 1936, complete.....	\$2.50
Volume 13, subscription, 1937	\$2.50

Special publications:

No. 1. Foraminifera, Their Classification and Economic Use. 1928	\$5.00
No. 2. A Resumé of New Genera of the Foraminifera Erected Since Early 1928. 1930.50
No. 3. A Bibliography of American Foraminifera. 1932.....	1.10
No. 4. Foraminifera, Their Classification and Economic Use, Ed. 2. 1933.	
No. 5. An Illustrated Key to the Genera of the Foraminifera. 1933. (No. 5 alone \$2.00; foreign \$2.50. Nos. 4 and 5 together \$5.00; foreign \$6.00. No. 4 not sold separately.)	
No. 6. New Genera and Species of the Families Verneuilinidae and Valvulinidae and of the Subfamily Virgulininae. 1936.....	1.50
For continuation of this series, see back cover page.	

Copies of Volume 13, part 3 were first mailed OCTOBER 13, 1937.

PRESS OF A. H. WILLIS, BRIDGEWATER, MASSACHUSETTS, U. S. A.

CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

187. NOTES ON SOME OF THE EARLY DESCRIBED EOCENE SPECIES OF *BULIMINA* AND *BULIMINELLA*

By JOSEPH A. CUSHMAN and FRANCES L. PARKER

In the previous issue of these Contributions, we presented some notes on the European Miocene species ("Eocene" incorrectly used in title). We have studied the early species described from the Eocene of Europe and New Zealand, using topotype material where possible, and these notes will give our interpretation of some of these species. From a study of some of Terquem's types in Paris, it was found that the illustrations were often very inadequate, and frequently gave a false idea of the species. Owing to the importance of those earlier described species, the names of which have often been used by later authors for very different species, it would be a great help if someone would study and carefully refigure Terquem's types from the Paris Basin and elsewhere, as Dr. Macfadyen has done for some of the Jurassic species described by Terquem. By a careful comparison of the descriptions with topotype material, we hope that we have been able to interpret correctly some of these species, but there are others which must be left until the actual types can be restudied.

In his work on the Foraminifera of the Paris Basin Eocene (*Mém. Soc. Géol. France*, ser. 3, vol. 2, 1882), Terquem uses 28 different specific names under the genus *Bulimina*. Two localities are given, Vaudancourt and Septeuil. From the former locality we have excellent topotype material, but not from Septeuil from which the majority of the species were obtained by Terquem. He refers to most of the species as very rare so that our finding of but a small proportion of the species is not surprising. Some of these, however, seem to be fairly well characterized, while of

others we have doubtful material which should be compared with the types. In addition we have studied hundreds of specimens from various other localities in the Eocene of the Paris Basin. There is a very considerable variation in the megalospheric and microspheric forms, and we have tried to have large enough series to take this factor into account in our studies.

BULIMINA PUPULA Stache (Pl. 9, figs. 1, 2)

Bulimina pupula STACHE, Novara-Exped., Geol. Theil, Bd. 1, Abt. 2, 1865, p. 265, pl. 24, fig. 13.
B. ovata STACHE (not D'ORBIGNY), l. c., p. 266, pl. 24, fig. 14.
B. aperta STACHE, l. c., p. 266, pl. 24, fig. 15.
B. propinqua STACHE, l. c., p. 267, pl. 24, fig. 16.

Test large, 2-2½ times as long as broad, fusiform, greatest breadth at or above the middle, initial end subacute or rounded; chambers distinct, only slightly inflated, tending to become somewhat biserial in the adult; sutures distinct, slightly depressed, curved; wall smooth, distinctly perforate, thick; aperture narrow, elongate, with a distinct tooth and slight lip. Length up to 1.25 mm.; breadth 0.50 mm.

Stache's types are from the Eocene of New Zealand, Whaingaroa Bay. Our figured species are topotypes. It is probable that all four names given above really represent a single species. It seems very close to *Bulimina pupoides* d'Orbigny, but is larger, has less inflated chambers and a thicker wall.

BULIMINA TRUNCANA Gümbel (Pl. 9, fig. 3)

Bulimina truncana GÜMBEL, Abhandl. kön. bay. Akad. Wiss., München, Cl. II, vol. 10, 1868 (1870), p. 644, pl. 2, figs. 77 a, b.—HANTKEN, Magy. kir. földt. int. évkönyve, vol. 4, 1875 (1876), p. 52, pl. 7, fig. 5; Mitth. Jahrb. k. ungar. geol. Anstalt, vol. 4, 1875 (1881), p. 61, pl. 7, fig. 5.—LIEBUS, Jahrb. k. k. Geol. Reichsanst., vol. 56, 1906, p. 368.

Test medium sized to large, about 1½ times as long as broad, very rapidly tapering from the acute initial end, sides of adult nearly parallel, apertural end obliquely truncate; chambers rather indistinct, little if at all inflated, regularly triserial; sutures mostly indistinct; wall ornamented by a series, 10-12, of longitudinal, acute costae, running from the initial end to the base of the smooth, last-formed chamber, independent of the sutures and chambers; aperture broadly loop-shaped with a slight lip. Length up to 1.50 mm.; breadth up to 1.00 mm.

The types are from the Eocene of Hammer, Bavaria. It also

occurs in the Eocene of the Gotzreuther Graben, Bavaria; from the Eocene of the "Clavulina-szaboi" beds near Budapest, Hungary; and the Eocene, Blue Marl, of Biarritz, France, from which localities we have abundant material. The species is a variable one. The specimens figured by Gümbel were evidently young specimens, while that figured by Hantken is an adult. When fully matured, the last-formed chamber is smooth. This species is evidently related to Brady's *Bulimina rostrata*.

BULIMINA SIMPLEX Terquem (Pl. 9, fig. 4)

Bulimina simplex TERQUEM, Mém. Soc. Géol. France, ser. 3, vol. 2, 1882, p. 109, pl. 11 (19), figs. 23, 24.

Test of medium size, elongate, tapering from the acute initial end to the greatest breadth at the last-formed whorl, about $2\frac{1}{2}$ times as long as broad; chambers distinct, inflated, regularly triserial, increasing rather uniformly in size as added; sutures distinct, depressed; wall smooth, very finely perforate; aperture large, somewhat quadrate, with a slight tooth and a slight but definite lip, in a distinct depression of the apertural face. Terquem's specimens, length 0.29 mm.; breadth 0.14 mm. Our specimens, length 0.30-0.40 mm.; breadth 0.13-0.17 mm.

Terquem's types are from Vaudancourt. We have specimens from the following localities in the Eocene of the Paris Basin: Vaudancourt; Grignon; Beauvais; Heronval; Chaumont; Chameray; and Cuise la Motte.

Our material shows this to have a more regular test than is indicated by the original figure, a regularly triserial arrangement of the chambers, and a large aperture.

BULIMINA TRIGONA Terquem (Pl. 9, fig. 5)

Bulimina trigona TERQUEM, Mém. Soc. Géol. France, ser. 3, vol. 2, 1882, p. 110, pl. 11 (19), figs. 28, 29.

Test nearly twice as long as broad, regularly triserial, rather regularly tapering from the subacute initial end to the greatest breadth formed by the last two chambers, periphery rounded; chambers distinct, inflated, increasing rapidly in height and size as added, the last whorl in front view making up nearly the whole surface of the test; sutures distinct, depressed; wall smooth; aperture a rounded opening, somewhat longer than wide, with a slight lip, narrowest at the base of the apertural face. Length 0.42-0.58 mm.; breadth 0.28-0.35 mm.

Terquem's types were from Vaudancourt in the Paris Basin. Our figured specimen is a topotype. We have it also from Beauves.

The aperture is large and rounded, and in Terquem's figures is shown as removed from the base of the chamber, but in our specimens it comes to the base. The last-formed whorl makes a large proportion of the surface of the test.

BULIMINELLA IRREGULARIS (Terquem) (Pl. 9, figs. 6, 7)

Bulimina irregularis TERQUEM, Mém. Soc. Géol. France, ser. 3, vol. 2, 1882, p. 112, pl. 12 (20), fig. 1.

Bulimina flexa TERQUEM, l. c., p. 115, pl. 12 (20), fig. 15.

Test small, elongate, tapering from the subacute or spinose initial end to the greatest breadth made by the last-formed whorl, 2½-3 times as long as broad, initial end often with a distinct, acerose spine; chambers distinct, slightly inflated, 4 or 5 in the adult whorl, increasing very gradually in size as added; sutures distinct, slightly depressed, somewhat limbate; wall smooth except about the aperture where there are numerous radiating lines or slight ridges; aperture very small, broadly loop-shaped at the inner margin of the apertural face which is strongly depressed with a rounded lip. Length of Terquem's species 0.37 mm.; breadth 0.16 mm. Our specimens, length 0.25-0.35 mm.; breadth 0.11-0.14 mm.

Terquem's types are from Vaudancourt where it is recorded as very rare. Our figured specimens are from the sand of Chamery.

Terquem's figure of this species gives the characters of the apertural face which is very distinctive. The form of the test is variable as shown by the two extremes given on our plate. The two may possibly be distinct varieties, but this should only be determined by a larger series of specimens than we have available at present.

It seems very probable that *Bulimina flexa* is a synonym, as Terquem's original descriptions of the two species coincide almost exactly.

BULIMINELLA TURBINATA (Terquem) (Pl. 9, figs. 8, 9)

Bulimina turbinata TERQUEM, Mém. Soc. Géol. France, ser. 3, vol. 2, 1882, p. 113, pl. 12 (20), figs. 6, 7.

Test small, 2-2½ times as long as broad, somewhat fusiform, initial end subacute; chambers numerous, slightly if at all inflated, in about four whorls, the adult whorl with 6 or 7 chambers,

elongate and narrow; sutures distinct, little if at all depressed, slightly limbate; wall smooth, finely perforate; aperture broadly loop-shaped in a distinct depression and with a broadly rounded lip. Length of Terquem's specimens 0.50-0.52 mm.; breadth 0.24-0.30 mm. Our specimens, length 0.30-0.35 mm.; breadth 0.10-0.15 mm.

Terquem records the species as very rare from Vaudancourt. We have numerous specimens referable to this species from the Calcaire grossier inferieur of Vaudancourt, Grignon, St. Frederic, and Beauvais as well as from material labeled "Lutetien inferieur" from Montainville (Seine et Oise), from Uilly-St. Georges (Oise), and from the "Sande of Chamery."

Microspheric specimens show a somewhat more acute initial end than the megalospheric one we figure, and the shape is more distinctly fusiform.

BULIMINELLA PULCHRA (Terquem) (Pl. 10, figs. 1, 2)

Bulimina pulchra TERQUEM, Mém. Soc. Géol. France, ser. 3, vol. 2, 1882, p. 114, pl. 12 (20), fig. 8, (9-12?).

Test small, about 2½ times as long as broad, composed of 3 or 4 whorls, the last one forming about ⅔ of the surface of the test; chambers distinct, slightly if at all inflated, 5 or 6 in the adult whorl, slightly fewer in the earlier whorls, increasing very slightly in size as added; sutures distinct, spiral suture depressed, others slightly so if at all; wall smooth; aperture an elongate opening, in a depression at the inner margin of the last-formed chamber. Length 0.40-0.45 mm.; diameter 0.18-0.20 mm.

Terquem's types were from Septeuil where it was recorded as rare. In our material it has seemed to be a common species of the Paris Basin. Our figured specimen is from Beauves, and we have specimens also from Vaudancourt; Chaumont (Oise); Mouchy (Oise); St. Felice (Oise), and from the "Sande of Chamery."

Terquem evidently figured more than one form under this name. We have selected the first of his figures as the type, and our specimens agree well with it.

BULIMINELLA STRIATO-PUNCTATA (Terquem) (Pl. 10, fig. 3)

Bulimina striato-punctata TERQUEM, Mém. Soc. Géol. France, ser. 3, vol. 2, 1882, p. 116, pl. 12 (20), fig. 19.

Test small, elongate, 2½-3 times as long as broad, sides in the middle portion nearly straight and parallel, initial end subacute,

apertural end somewhat truncate; chambers numerous, very slightly inflated, in numerous whorls, usually only three to a whorl, but the final chamber somewhat offset from the others; sutures distinct, very slightly depressed; wall ornamented by rather coarse punctae arranged in longitudinal lines; aperture elongate, rounded, at the inner margin of the last-formed chamber in a distinct depression of the apertural face. Length 0.30-0.60 mm.; breadth 0.12-0.16 mm.

Terquem's types were from Septeuil. Our figured specimens are from St. Frederic, near Grignon, and agree fairly well with Terquem's figures and description. The last-formed chamber and the end view seem to place this species in *Buliminella*, although it is not as typical as some of the other species.

BULIMINELLA SEMI-NUDA (Terquem) (Pl. 10, figs. 4, 5)

Bulimina semi-nuda TERQUEM, Mém. Soc. Géol. France, ser. 3, vol. 2, 1882, p. 117, pl. 12 (20), fig. 21.

Test of medium size, about 1½ times as long as broad, initial end acute, often with a short, stout spine, greatest breadth at about the middle; chambers numerous, not inflated, 7-8 in the adult whorl, increasing very gradually in size as added; sutures rather indistinct, not depressed; wall, especially of the earlier portion, ornamented with numerous, irregular, longitudinal costae becoming obsolescent on the upper portion of the adult whorl; aperture rounded, in a distinct depression at the inner margin of the obliquely truncate, apertural face. Length 0.40-0.55 mm.; breadth 0.20-0.30 mm.

Terquem's types were from Septeuil where the species is recorded as very rare. Our specimens are from Beauves, from the zone of *Cerithium giganteum*. The figured specimens show both the usual form and a larger adult specimen with the expanded final chambers.

BULIMINA TENUISTRIATA Terquem (Pl. 10, fig. 6)

Bulimina tenuistriata TERQUEM, Mém. Soc. Géol. France, ser. 3, vol. 2, 1882, p. 118, pl. 12 (20), figs. 24, 25.

Test of medium size, tapering, the initial end subacute or slightly rounded, apertural end broadly truncate, about 1½ times as long as broad; chambers fairly distinct, slightly inflated, later ones more strongly so, earlier ones often indistinct; sutures except in the later portion indistinct, only slightly depressed in the

later portion; wall ornamented by fine lines or ridges, in general parallel to the middle longitudinal line of the chamber, and those of each chamber distinct from adjacent ones; aperture small, in a distinct depression of the apertural end of the test. Terquem's specimens, length 0.50-0.54 mm.; breadth 0.35-0.36 mm. Our specimens, length 0.34-0.45 mm.; breadth 0.20-0.30 mm.

Terquem's types are from Vaudancourt. Specimens referable to this species are in our collection from the following localities in the Eocene of the Paris Basin: Vaudancourt and Beauves.

BULIMINELLA TERQUEMIANA (Heron-Allen and Earland) (Pl. 10, fig. 7)

Bulimina obliqua TERQUEM (not d'ORBIGNY), Mém. Soc. Géol. France, ser. 3, vol. 2, 1882, p. 118, pl. 12 (20), fig. 23.

B. terquemiana HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1911, p. 314, pl. 9, figs. 13, 14.

The following description and notes are those given by Heron-Allen and Earland in the above reference:

"We have two specimens of the pretty little form figured and described by Terquem under the name of *B. obliqua*. As, however, the specific name *obliqua* has already been used by d'Orbigny for a distinct form, we have associated Terquem's specimens with the name of the author. His description is as follows: 'Shell irregular, more developed on one side than the other; sub-rotund, enlarged anteriorly, domed posteriorly, and furnished with a small spur. Domed on one side and incurved on the other; ornamented with very fine and curved sulci. Formed of three whorls of prominent spiral layers, oblique, elongated, chambers indistinct, the last whorl highly developed, aperture round, situated in a very large lateral depression of a pointed oral shape furnished with a thickened rim.' Terquem's specimens were from the Eocene of Septeuil, near Paris—very rare—and ours are doubtless fossils derived from a similar formation. Length, 0.27 mm. Breadth, 0.18 mm."

Heron-Allen and Earland's specimens were from Selsey Bill, England. Copies of their figures are given here. We have had no actual topotype material, but have specimens from the Eocene of the Paris Basin from Vaudancourt; Beauves; St. Frederic near Grignon; Fontenoy; Chaumont (Oise); and sand of Chamery.

QUESTIONABLE SPECIES

The following Eocene species we have found either not to belong to *Bulimina* or *Buliminella* or that they cannot be positively identified in the material available to us at this time. Notes are given in the case of a number of the species. They are arranged in chronological order.

Bulimina textilariformis STACHE. (Novara-Exped., Geol. Theil., vol. 1, 1864, p. 268, pl. 24, figs. 17 a-c.) Not a *Bulimina*.

B. arcuata STACHE. (l. c., p. 269, pl. 24, figs. 18 a-c.) Not a *Bulimina*.

B. eocena HANTKEN. (A magy. kir. földt. int. évkönyve, vol. 1, 1871, p. 129, pl. 2, fig. 16.) No topotype material available. Figure shows rear view only.

B. ovigera TERQUEM. (Mém. Soc. Géol. France, ser. 3, vol. 2, 1882, p. 108, pl. 11 [19], figs. 17-20.) = *Robertina ovigera* (TERQUEM).

B. longiscata TERQUEM. (l. c., p. 109, pl. 11 [19], figs. 25, 26.) We have specimens very close to the figures, and these seem nearest to the *Uvigerina* group. Terquem describes the species as having a "tunnel-shaped" aperture.

B. uviformis TERQUEM. (l. c., p. 110, pl. 11 [19], figs. 27 a, b.) An arenaceous form.

B. candida TERQUEM. (l. c., p. 111, pl. 11 [19], figs. 30, 31.) Figures too poor to make a definite identification with any of our material.

B. obscura TERQUEM. (l. c., p. 111, pl. 11 [19], figs. 32 a, b.) Figures lack details, and are too vague to make identification with any of our material possible.

B. trocheata TERQUEM. (l. c., p. 111, pl. 11 [19], fig. 33.) An arenaceous form, possibly an *Arenobulimina*.

B. oviformis TERQUEM. (l. c., p. 112, pl. 12 [20], fig. 3.) No specimens resembling the figure which is very vague.

B. glanduliformis TERQUEM. (l. c., p. 113, pl. 12 [20], p. 4.) Figure inadequate for identification.

EXPLANATION OF PLATE 9

FIGS.

- 1, 2. *Bulimina pupula* Stache. $\times 40$. Fig. 1, Megalospheric. Fig. 2, Microspheric.
3. *B. truncana* Gümbel. $\times 120$.
4. *B. simplex* Terquem. $\times 90$.
5. *B. trigona* Terquem. $\times 70$.
- 6, 7. *Buliminella irregularis* (Terquem). $\times 130$. Fig. 6, Microspheric. Fig. 7, Megalospheric.
- 8, 9. *B. turbinata* (Terquem). $\times 145$.

In all figures: *a*, front view; *b*, rear view; *c*, apertural view.





B. ovula TERQUEM. (l. c., p. 113, pl. 12 [20], fig. 4.) A homonym of d'Orbigny, 1839.

B. scalariformis TERQUEM. (l. c., p. 114, pl. 12 [20], fig. 13.) No Paris Basin material found that could be identified with this figure.

B. auriculata TERQUEM. (l. c., p. 115, pl. 12 [20], fig. 14.) Nothing found that could be identified with this figure.

B. intorta TERQUEM. (l. c., p. 115, pl. 12 [20], fig. 16.) Figure obviously inaccurate.

B. conulus TERQUEM. (l. c., p. 116, pl. 12 [20], fig. 17.) Nothing that could be identified with this found in our Paris Basin material.

B. pupa TERQUEM. (l. c., p. 116, pl. 12 [20], figs. 18 *a*, *b*.) No specimens found in our Paris Basin material identifiable with this.

B. splendens TERQUEM. (l. c., p. 117, pl. 12 [20], fig. 20.) Figure inadequate for identification.

B. decorata TERQUEM. (l. c., p. 117, pl. 12 [20], fig. 22.) Figure evidently inaccurate as to sutures. May be same as *B. tenuistriata* Terquem, which it apparently resembles in surface characters.

B. obliqua TERQUEM. (Not d'ORBIGNY.) (l. c., p. 118, pl. 12 [20], fig. 23.) See *Buliminella terquemiana* (Heron-Allen and Earland).

B. truncana GÜMBEL, var. *angusta* GRZYBOWSKI. (Rozprawy Spraw. mat.—przyr. uhad. Krakow, vol. 9, 1894, p. 189, pl. 2, fig. 11.) No topotype material available.

B. elongata d'ORBIGNY, var. *cylindrica* GRZYBOWSKI. (l. c., p. 189, pl. 2, fig. 14.) No topotype material available.

B. selseyensis HERON-ALLEN and EARLAND. (Journ. Roy. Micr. Soc., 1911, p. 313, pl. 10, figs. 1, 2.) No topotype material available. Figure suggests *Angulogerina*.

B. imbricata REUSS, var. *procera* LIEBUS. (Jahr. Geol. Bunde-Samst. Wien, 1928, p. 368, pl. 13, figs. 8 *a*, *b*.) No topotype material available.

EXPLANATION OF PLATE 10

FIGS.

1, 2. *Buliminella pulchra* (Terquem). $\times 90$. Fig. 1, From Beauves. Fig. 2, From Mouchy.

3. *B. striato-punctata* (Terquem). $\times 130$.

4, 5. *B. semi-nuda* (Terquem). $\times 130$. Fig. 4, Medium sized form. Fig. 5, Adult.

6. *Bulimina tenuistriata* Terquem. $\times 130$.

7. *Buliminella terquemiana* (Heron-Allen and Earland). (After Heron-Allen and Earland.) $\times 100$.

In all figures: *a*, front view; *b*, rear view; *c*, apertural view.

188. THE DESCRIBED AMERICAN EOCENE SPECIES OF
UVIGERINA

By JOSEPH A. CUSHMAN and PATRICIA G. EDWARDS

A continuation of the study of the species of *Uvigerina* and allied genera has necessitated the review of the American Eocene species already described. As these are scattered in the literature, it has been thought useful to other workers to bring these together to make comparisons easier. In a number of species new figures are given from types and topotypes in the collections in this laboratory, as the earlier figures in several cases are not complete in their details. Original figures are reproduced where typical specimens are not available to us.

UVIGERINA ALATA Cushman and Applin (Pl. 11, figs. 1, 2)

Uvigerina alata CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 176, pl. 8, figs. 11-13.—ELLISOR, l. c., vol. 17, 1933, pl. 3, figs. 11, 12.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 39, pl. 15, figs. 8-10.

Test elongate, about twice as long as broad; chambers distinct, inflated; sutures distinct, depressed; wall ornamented with a few, very prominent, thin, high, plate-like costae, usually extending posteriorly beyond the limits of the chambers; apertural end of last-formed chamber truncate, with a very short, cylindrical neck, in a depression of the terminal face. Maximum length 0.75 mm.; breadth 0.30-0.35 mm.

The types of this species are from the upper Eocene, Jackson, of Ohio and Red River well 2, Tyler Co., Tex., at a depth of 1,056 feet. It has been recorded only from Texas.

UVIGERINA BLANCA-COSTATA Cole (Pl. 11, figs. 3, 4)

Uvigerina blanca-costata COLE, Bull. Amer. Pal., vol. 14, No. 51, 1927, p. 26, pl. 2, fig. 14.

Test small, fusiform, periphery strongly lobulate; chambers distinct, inflated, later ones in the adult more loosely coiled; wall ornamented with longitudinal costae, limited to the individual chamber, not confluent with those of the adjacent chambers above and below, earliest ones and sometimes the later ones tending to

become broken into spines; aperture a very short, tapering neck. Length 0.30-0.35 mm.; thickness 0.17-0.20 mm.

The type is from the Guayabal (Claiborne) Eocene of Guayabal, Mexico. Our figured specimens are topotypes.

UVIGERINA BONAIRENSIS Pijpers (Pl. 11, fig. 5)

Uvigerina bonairensis PIJPERS, Geol. Pal. Bonaire, 1933, p. 69, text figs. 95, 96.

"Test sub-oval in cross section. Initial end bluntly pointed. Test rapidly attaining largest width. Width decreasing near apertural end. Sutures rather distinct, depressed. Chambers few, high, early chambers irregularly arranged, with indistinct sutures and ca. 17 well marked costae. Aperture terminal, rounded, with distinct neck."

"The Bonaire species is closest to *U. oligocaenica* Andreæ. The latter species is longer and narrower, more tapering towards the apertural end, with a longer and thinner neck."

The types are from the upper Eocene of a well near Porto Spaño (Columbia Plantation), Bonaire, D. W. I.

The type figures are copied, but do not give an adequate idea of the species, and we have no topotypes. The author compares it with some of the figures referred to *U. cocoaensis* Cushman. It may be related to *U. topilensis* Cushman.

UVIGERINA BOQUERONENSIS Coryell and Embich (Pl. 11, fig. 6)

Uvigerina boqueronensis CORYELL and EMBICH, Journ. Pal., vol. 11, 1937, p. 304, pl. 42, fig. 24.

"Test free, conical, greatest diameter about the middle; round or generally oval in outline of cross-section; early chambers marked with longitudinal costae for about the first three whorls; costae are confluent from one chamber to another; in the later whorls the ornamentation consists of spines; the last spinose whorl is of less diameter than the whorl preceding, more loosely arranged, and thus the outline is made more lobulate; aperture at the end of a short cylindrical neck with a phialine lip. Length 0.45 mm."

The types are from the Eocene, Tranquilla shale, Panama.

The original figure and description are copied here. We have had no specimens.

76 CONTRIBUTIONS FROM THE CUSHMAN LABORATORY

UVIGERINA CAMAGUEYANA Bermudez (Pl. 11, fig. 7)

Uvigerina camagüeyana BERMUDEZ, Mem. Soc. Cubana Hist. Nat., vol. XI, 1937, p. 144, pl. 17, fig. 10.

Test short and broad, about $\frac{2}{3}$ as broad as long, fusiform, greatest breadth above the middle, periphery lobulate; chambers fairly distinct, inflated; sutures depressed; wall ornamented by high, plate-like longitudinal costae, 15-18 in the circumference at the widest part, those of each chamber independent of those of adjoining ones; aperture with a very short, cylindrical neck and broad, slightly reflexed, phialine lip. Length 0.80 mm.; breadth 0.60 mm.

The types are from the Eocene, just N. of Grua 9, Ramal Juan Criollo of Central Jatibonico, Camaguey, Cuba, and are deposited in the collections of this laboratory through the kindness of Dr. Bermudez. The original figure is copied here.

UVIGERINA COCOAENSIS Cushman (Pl. 11, figs. 8, 9)

Uvigerina cocoaensis CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 3, 1925, p. 68, pl. 10, fig. 12; U. S. Geol. Survey Prof. Paper 181, 1935, p. 39, pl. 15, figs. 11-13.

Test of medium size for the genus, elongate, fusiform, greatest width slightly above the middle, periphery very slightly lobulate; chambers rather few, inflated, evenly rounded; sutures slightly depressed; wall ornamented with coarse, longitudinal costae, not usually confluent with those of adjacent chambers, becoming lower and less conspicuous in later chambers, the last-formed chamber in the adult usually smooth, about 12-16 costae in the complete circumference in the widest part; apertural end with a short, cylindrical neck and phialine lip. Maximum length 0.80 mm.; breadth 0.30-0.35 mm.

The type is from the upper Eocene of Cocoa, Ala. It also occurs in the Ocala limestone of Alabama, and in the Jackson formation of Alabama and Mississippi.

It is probable that the specimens referred to this species from Texas and Mexico should be referred to *U. topilensis* Cushman.

UVIGERINA COOKEI Cushman (Pl. 11, figs. 10, 11)

Uvigerina cookei CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 39, pl. 15, figs. 14-16.

Test of large size for the genus, elongate, subcylindrical, slightly fusiform, greatest width above the middle, periphery

slightly lobulate; chambers numerous, inflated, evenly rounded; sutures slightly depressed; wall ornamented with sharp, low, longitudinal costae, in part confluent with those of chambers above and below, usually reduced on the last-formed chamber in the adult, about 24-30 costae in the complete circumference in the widest part; apertural end with a very short, cylindrical neck and wide, phialine lip. Maximum length 1.20 mm.; breadth 0.35-0.40 mm.

The types of this species are from the upper Eocene, Ocala limestone, $3\frac{1}{4}$ miles N. of Grove Hill, Ala. It also occurs in the upper Eocene, Castle Hayne marl, of North Carolina, Cooper marl of South Carolina, Ocala limestone of Georgia and Alabama, and the Jackson formation of Alabama.

This is one of the largest species of our upper Eocene. The costae are very numerous, but not highly developed. The neck is very short and stout.

UVIGERINA CURTA Cushman and Jarvis (Pl. 11, figs. 12, 13)

Uvigerina curta CUSHMAN and JARVIS, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 13, pl. 3, figs. 13-15.

Test small, very short and stout, only slightly longer than broad; chambers few, inflated; sutures depressed, earlier ones largely obscured by the ornamentation; wall of the earlier portion with very high, thin, sharp costae, some independent on each chamber, others continuous over several chambers, about 12 in the complete circumference, usually obsolete in the last 1 or 2 chambers; aperture with a short, cylindrical neck in a distinct depression of the apertural face, with a thin, phialine lip, somewhat sinuous instead of in one plane, apertures often double. Maximum length 0.60 mm.; breadth 0.45 mm.

The types are from Eocene shales, just north of Point Bontour, Trinidad, B. W. I.

This is a very short, stout species, and tends to have the apertures twinned.

UVIGERINA DANVILLENSIS Howe and Wallace (Pl. 11, fig. 14)

Uvigerina danvillensis HOWE and WALLACE, Louisiana Geol. Bull. No. 2, 1932, p. 62, pl. 12, fig. 5.

"Test subfusiform, greatest diameter near the midportion, about twice as long as broad, almost circular in cross section; chambers inflated, arranged in a loose triserial series; sutures

more or less indistinct, depressed; all chambers except the last possess high, plate-like costae, some extending across two or three chambers, the initial end ornamented with four of these costae extending vane-like well beyond the posterior limits of the test; wall calcareous, finely perforate, costae clear, glassy; aperture circular, excentric, at the end of a moderately long neck, surrounded by a phialine lip. Length 0.5 mm.

"This species is distinguished by the peculiar high, plate-like costae."

The types are from the upper Eocene, Jackson, of the upper horizon at Danville, La. The type figure is copied here. We have looked through material from the type locality kindly sent us by Dr. Howe, but without finding specimens of this species. The authors record it as rare.

UVIGERINA DUMBLEI Cushman and Applin (Pl. 11, fig. 17)

Uvigerina dumblei CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 177, pl. 8, fig. 19.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 39, pl. 15, fig. 17.

Test large, periphery rounded, very slightly lobulate, the sides nearly parallel for most of the length, nearly twice as long as broad; chambers distinct, slightly inflated; sutures distinct, slightly depressed; wall ornamented by very fine, longitudinal costae, 30 or more in the complete circumference, those of each chamber independent of the others and extending backward, making the sutures crenulate; apertural end with a slightly projecting, cylindrical neck. Maximum length 1.00 mm.; breadth 0.45 mm.

The types of this species are from Haynes well 1, near Burkeville, Newton Co., Tex., at a depth of 3,175-3,270 feet. It has not been recorded elsewhere.

UVIGERINA ELONGATA Cole (Pl. 11, figs. 15, 16)

Uvigerina elongata COLE, Bull. Amer. Pal., vol. 14, 1927, No. 51, p. 26, pl. 4, figs. 2, 3.

Test small, elongate, early portion compact and close coiled, later tending to become uniserial, later portion with the periphery distinctly lobulate; chambers of the later portion distinct and strongly inflated; sutures indistinct in the earlier portion, later distinct and depressed; wall distinctly hispid throughout; aperture with an elongate, slender, cylindrical neck and a distinct,

phialine lip, sometimes with a distinct tooth. Length 0.30-0.40 mm.; breadth 0.18-0.20 mm.

The types are from the Guayabal formation (Claiborne) of Guayabal, Mexico. Our figures are of topotype specimens kindly sent us by Dr. Cole.

UVIGERINA GARDNERAE Cushman (Pl. 11, figs. 19, 20)

Uvigerina gardnerae CUSHMAN, in Cushman and Applin, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 175, pl. 8, figs. 16, 17.—COLE, Bull. Amer. Pal., vol. 14, No. 53, 1928, p. 213 (13), pl. 2, fig. 5.—HOWE and WALLACE, Louisiana Geol. Bull. No. 2, 1932, p. 63, pl. 12, fig. 6.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 40, pl. 15, figs. 18, 19.

Test of medium size for the genus, much elongated, slender, early portion with the chambers somewhat loosely arranged, periphery somewhat lobulate; chambers numerous, inflated, especially the later ones, earlier ones with the basal margin tending to overhang the preceding ones; wall ornamented with longitudinal costae in the earlier portion, as many as 20 in the complete circumference, costae later tending to break up into lines of spines, the later portion of the test generally hispid; apertural end with a slightly tapering, subcylindrical neck and slight, phialine lip. Maximum length 0.80 mm.; breadth 0.25 mm.

The types are from Ohio and Red River well 2, Tyler Co., Tex., at a depth of 1,056 feet. It occurs also in the upper Eocene, Cooper marl, of South Carolina, Ocala limestone of Florida and Alabama, and the Jackson formation of Alabama, Mississippi and Louisiana. Very similar specimens occur in the upper Eocene of Mexico in so-called Alazan clays.

UVIGERINA GARDNERAE Cushman, var. TEXANA Cushman and Applin (Pl. 11, fig. 18)

Uvigerina gardnerae CUSHMAN, var. *texana* CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 175, pl. 8, fig. 18.—HOWE and WALLACE, Louisiana Geol. Bull. No. 2, 1932, p. 64, pl. 12, figs. 3, 9.—ELLISOR, Bull. Amer. Assoc. Petr. Geol., vol. 17, 1933, pl. 3, fig. 15.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 40, pl. 15, fig. 20.

Variety differing from the typical form in being much more elongate; later portion is somewhat less in diameter than the earlier part. Length 0.60 mm.; breadth 0.20 mm.

The types are from Ohio and Red River well 2, Tyler Co., Tex., at a depth of 1,056 feet. The only records are from the upper Eocene of Texas and Louisiana.

UVIGERINA GLABRANS Cushman (Pl. 11, fig. 21)

Uvigerina glabrans CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 13, pl. 1, fig. 28; U. S. Geol. Survey Prof. Paper 181, 1935, p. 40, pl. 15, fig. 21.

Test of medium size for the genus, elongated, subcylindrical, or slightly fusiform, greatest width usually below the middle, periphery only slightly lobulate; chambers comparatively few, inflated, evenly rounded; sutures very slightly depressed; wall smooth, or with faint traces of costae near the initial end, finely perforate; apertural end truncate, with a short, delicate, cylindrical neck and phialine lip, the neck often broken. Maximum length 0.75 mm.; breadth 0.30-0.35 mm.

The types are from the upper Eocene, Jackson, 3½ miles SE. of Cullomburg, Ala. It also occurs in the Cooper marl of South Carolina, and in the Ocala limestone of Alabama.

UVIGERINA GLADYSÆ Cole (Pl. 12, fig. 1)

Uvigerina gladyssæ COLE, Bull. Amer. Pal., vol. 14, No. 51, 1927, p. 27, pl. 5, fig. 11.

"Test minute, about as broad as long, apertural end the largest; chambers few, strongly inflated; sutures distinct; the initial chambers having 3-5 short spines, test otherwise without ornamentation; aperture circular on the end of a short neck. Length 0.15 mm."

This species was described from the Guayabal formation (Clairborne) of Guayabal, Mexico. Though it is recorded as "fairly common," we found no specimens that we could refer to it in the Guayabal material send us by Dr. Cole.

UVIGERINA HAVANENSIS Cushman and Bermudez (Pl. 12, figs. 2, 3)

Uvigerina havanensis CUSHMAN and BERMUDEZ, Contr. Cushman Lab. Foram. Res., vol. 12, 1936, p. 59, pl. 10, figs. 19-21.

Test slender, elongate, about 2½ times as long as broad, initial end with several short, acicular spines, tapering, greatest breadth at the last-formed chambers, periphery lobulate; chambers distinct, somewhat inflated, increasing rather gradually in size, later ones tending to become uniserial; sutures distinct, depressed; wall ornamented by numerous, high, raised costae, sharp and plate-like, those of each chamber independent of adjacent ones; aperture nearly terminal with a very short neck and distinct lip. Length 1.15-1.25 mm.; diameter 0.40-0.45 mm.

The types are from the Eocene, 1 km. N. of Arroyo Arenas, on road to Jaimanitas (water well), Havana Province, Cuba.

It differs from *U. jacksonensis* Cushman in the much more elongate, slender form with the greatest breadth toward the apertural end instead of in the middle, and the more numerous high costae.

UVIGERINA JACKSONENSIS Cushman (Pl. 12, figs. 4, 5)

Uvigerina jacksonensis CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 3, 1925, p. 67, pl. 10, fig. 13; Journ. Pal., vol. 1, 1927, p. 163, pl. 25, fig. 3.—HOWE and WALLACE, Louisiana Geol. Bull. No. 2, 1932, p. 65, pl. 12, figs. 7, 8.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 40, pl. 16, figs. 1-3.

Test large for the genus, stout, broadly fusiform, greatest width at about the middle, periphery slightly lobulate; chambers rather few, inflated; sutures somewhat depressed, basal part of chamber not conspicuously overhanging, evenly curved; wall ornamented with coarse, longitudinal costae, in the early portion usually limited to the individual chamber, in the adult portion usually becoming confluent with those of the adjacent chambers above and below, outer edge of the costae entire, about 18-22 costae in the complete circumference in the widest part, apertural end with a tendency in the last-formed chamber to lose or reduce the costae; aperture with a cylindrical neck of medium length and a phialine lip. Maximum length 0.90 mm.; breadth 0.45 mm.

The types are from the upper Eocene, Jackson, of Cocoa, Ala. It occurs in the Cooper marl of South Carolina, the Ocala limestone of Georgia and Alabama, and in the Jackson formation of Alabama, Mississippi, and Louisiana as well as in Mexico.

This is a larger, stouter species than *U. yazooensis* Cushman, and has larger costae.

UVIGERINA RIPPENSIS Cole (Pl. 12, fig. 6)

Uvigerina rippensis COLE, Bull. Amer. Pal., vol. 14, No. 51, 1927, p. 27, pl. 2, fig. 16.

Test of medium size, elongate, about twice as long as broad, somewhat fusiform, periphery lobulate; chambers distinct, inflated; sutures distinct, depressed; wall ornamented with longitudinal costae, high and plate-like in the middle, broken into irregular spines toward either end, 20-25 in the complete circumference in the widest part; aperture with a short, broad,

cylindrical neck with a slight phialine lip. Length 0.50-0.75 mm.; breadth 0.30-0.40 mm.

The type is from the Eocene, Guayabal formation (Claiborne) of Guayabal, Mexico.

Our figure is from a topotype specimen kindly sent us by the author.

UVIGERINA SEMIVESTITA Bermudez (Pl. 12, figs. 7, 8)

Uvigerina semivestita BERMUDEZ, Mem. Soc. Cubana Hist. Nat., vol. XI, 1937, p. 143, pl. 17, figs. 8, 9.

Test large, about twice as long as broad, fusiform, greatest breadth at about the middle, periphery not lobulate; chambers somewhat obscured by the ornamentation, close-set, last chamber somewhat set off from the others; sutures fairly distinct, but only slightly depressed; wall ornamented by high, plate-like, longitudinal costae, 4 or 5 primary ones on each side of the test, with secondary ones between, the primary costae covering several chambers, last chamber smooth; aperture with a short, cylindrical neck and distinct, phialine lip. Length 0.90 mm.; breadth 0.50 mm.

The types are from the Eocene of Noroña, N. of Guanajay, Province of Pinar del Rio, Cuba, and are deposited in the collections of this laboratory. The original figures are copied here.

UVIGERINA SERIATA Cushman and Jarvis (Pl. 12, figs. 9, 10)

Uvigerina seriata CUSHMAN and JARVIS, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 13, pl. 3, figs. 11, 12.

Test elongate, 2½-3 times as long as broad, tapering, greatest breadth formed by the last-formed chamber, initial end subacute, tapering sharply even in the megalospheric form, periphery lobulate; chambers numerous, distinct, inflated, later ones showing a tendency to become biserial or even uniserial; sutures distinct, depressed; wall ornamented by numerous, slightly raised costae, 30-40 in the complete circumference at the widest part, somewhat anastomosing and mostly continuous over several chambers, some of the costae at the basal portion of each chamber forming short spines; aperture with a smooth, cylindrical neck and phialine lip. Length 0.90 mm.; breadth 0.38 mm.

The types are from the Eocene, "Sagrina-beds," of Trinidad Point, Oropouche Lagoon, Trinidad, B. W. I.

This is a distinctive species tending to become uniserial in the adult.

UVIGERINA SPINICOSTATA Cushman and Jarvis (Pl. 12, figs. 11, 12)

Uvigerina spinicostata CUSHMAN and JARVIS, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 12, pl. 3, figs. 9, 10.

Test fairly large, elongate, about 3 times as long as broad, microspheric form tapering, megalospheric form quickly reaching its full breadth, periphery lobulate; chambers numerous, distinct, inflated, especially the later ones; sutures in the later portion distinct and depressed; wall ornamented by numerous, high, plate-like costae, those of each chamber independent of adjacent ones, in the earlier portion broken up into spinose projections and sometimes in the later chambers, especially the basal portions of the costae; aperture with a stout neck and lip, the neck often spinose. Length of microspheric form 0.90 mm.; breadth 0.30 mm.

The types are from the Eocene, lower marl, Cipero Section, Trinidad, B. W. I.

This is a highly ornate species.

UVIGERINA SPINULOSA Coryell and Embich (Pl. 12, fig. 13)

Uvigerina spinulosa CORYELL and EMBICH, Journ. Pal., vol. 11, 1937, p. 304, pl. 42, fig. 23.

"Test free, bulbous, greatest diameter near the center; consisting of about four whorls, three chambers to a whorl in the early or initial part; chambers inflated and overhanging just above the suture lines; surface extremely hispid, short stout spines covering entirely each chamber. Aperture round, simple, at the end of a short thick neck. Length 0.45 mm."

The types are from the Eocene, Tranquilla shale, Panama.

The original figure and description are copied here. We have had no specimens.

UVIGERINA TOPILENSIS Cushman (Pl. 12, fig. 14)

Uvigerina topilensis CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 1, 1925, p. 5, pl. 1, figs. 5 *a*, *b*.—CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 176, pl. 8, fig. 14.—ELLISOR, I. c., vol. 17, 1933, pl. 3, fig. 14.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 41, pl. 16, fig. 4.

Test elongate, generally fusiform, broadest in the middle, initial and apertural ends both rounded; tending to become uniserial in the final portion; chambers distinct, inflated, irregularly spiral; sutures distinct, depressed; wall ornamented with a very few longitudinal costae, progressively decreasing in height to-

ward the apertural end of the test, and usually continuous from one chamber to another, last-formed portion of the test usually smooth, the costae on the earliest portion sometimes projecting backward into plate-like processes; aperture with a very slender, cylindrical neck. Length 0.70 mm.; breadth 0.30 mm.

The types are from the Eocene, Tantoyuca formation, yellow clay from Palacho Hacienda, S. of Panuco-Tampico RR., State of Vera Cruz, Mexico.

This species has evidently been confused with *U. cocoaensis* Cushman, and the Mexican and Texas specimens referred to this species may perhaps belong really to *U. topilensis*.

UVIGERINA WESTERMANNI Pijpers (Pl. 12, fig. 15)

Uvigerina westermanni PIJPERS, Geol. Pal. Bonaire, 1933, p. 69, text figs. 93, 94.

"Test with rounded initial end; from initial end gradually widening till about halfway the length of the test where it is widest, then narrowing first slowly, later rapidly, towards the aperture. Surface fairly smooth, sutures distinct, depressed; course of the sutures very peculiar. There are only few, high chambers, differing in shape and size. The species is sub-oval in cross section. Aperture terminal, a rounded neck with minute lip."

EXPLANATION OF PLATE 11

FIGS.

- 1, 2. *Uvigerina alata* Cushman and Applin. $\times 55$. (After Cushman.)
- 3, 4. *U. blanca-costata* Cole. $\times 130$. Topotypes.
5. *U. bonairensis* Pijpers. (After Pijpers.)
6. *U. boqueronensis* Coryell and Embich. $\times 80$. (After Coryell and Embich.)
7. *U. camagiayana* Bermudez. $\times 40$. (After Bermudez.)
- 8, 9. *U. cocoaensis* Cushman. $\times 55$. (After Cushman.)
- 10, 11. *U. cookei* Cushman. $\times 55$. (After Cushman.)
- 12, 13. *U. curta* Cushman and Jarvis. $\times 55$. 12, Holotype. 13, Paratype.
14. *U. danvillensis* Howe and Wallace. $\times 100$. (After Howe and Wallace.)
- 15, 16. *U. elongata* Cole. $\times 130$. Topotypes.
17. *U. dumblei* Cushman and Applin. $\times 30$. (After Cushman.)
18. *U. gardnerae* Cushman, var. *texana* Cushman and Applin. $\times 40$. (After Cushman.)
- 19, 20. *U. gardnerae* Cushman. $\times 40$. (After Cushman.)
21. *U. glabrans* Cushman. $\times 55$. (After Cushman.)





The types are from the upper Eocene of a well near Porta Spaño (Columbia Plantation), Bonaire, D. W. I.

We have had no topotypes of this species, and the description and figures are copied from the originals.

UVIGERINA YAZOOENSIS Cushman (Pl. 12, figs. 16, 17)

Uvigerina yazooensis CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 13, pl. 1, fig. 29; U. S. Geol. Survey Prof. Paper 181, 1935, p. 41, pl. 16, figs. 5, 6.

Test small, elongate, fusiform, greatest width toward the apertural end, periphery strongly lobulate; chambers numerous, inflated, basal portion of the chamber overhanging the preceding ones; sutures strongly depressed; wall ornamented with sharp, longitudinal costae, limited to the individual chamber, not in line with those of adjacent chambers above and below, outer edge of the costae often serrate, about 22-26 in the complete circumference in the widest part; apertural end with a short, slender, cylindrical neck and phialine lip. Maximum length 0.70 mm.; breadth 0.28 mm.

The types are from the upper Eocene, Jackson, $\frac{1}{2}$ mile SE. of Melvin, Ala. It also occurs in the Cooper marl of South Carolina, and in the Jackson formation of Mississippi. The form figured by Cole from the Chapapote formation of Mexico is very close to it.

EXPLANATION OF PLATE 12

FIGS.

1. *Uvigerina gladyuae* Cole. \times 135. (After Cole.)
- 2, 3. *U. havanensis* Cushman and Bermudez. \times 45. (After Cushman and Bermudez.)
- 4, 5. *U. jacksonensis* Cushman. \times 50. (After Cushman.)
6. *U. rippensis* Cole. \times 90. Topotype.
- 7, 8. *U. semivestita* Bermudez. \times 40. (After Bermudez.)
- 9, 10. *U. seriata* Cushman and Jarvis. \times 55. 9, Paratype. 10, Holotype.
- 11, 12. *U. spinicostata* Cushman and Jarvis. \times 55. 11, Paratype. 12, Holotype.
13. *U. spinulosa* Coryell and Embich. \times 70. (After Coryell and Embich.)
14. *U. topilensis* Cushman. \times 35. (After Cushman.)
15. *U. westermannii* Pijpers. (After Pijpers.)
- 16, 17. *U. yazooensis* Cushman. \times 65. (After Cushman.)
18. *U. yeguaensis* Weinzierl and Applin. \times 120. Holotype.
19. *Angulogerina parvula* (Cushman and Thomas). \times 120. (After Cushman and Thomas.)

not identical with *U. yazooensis*, (*U. byramensis* Cushman, var. Cole, Bull. Amer. Pal., vol. 14, No. 53, 1928, p. 213 [13], pl. 2, fig. 7).

UVIGERINA YEGUAENSIS Weinzierl and Applin (Pl. 12, fig. 18)

Uvigerina pygmaea d'ORBIGNY, var. *yeguaensis* WEINZIERL and APPLIN, Journ. Pal., vol. 3, 1929, p. 404.

Test fusiform, 2-2½ times as long as broad, greatest breadth slightly above the middle, periphery lobulate; chambers distinct, somewhat inflated; sutures distinct, depressed; wall ornamented in the earliest portion by longitudinal costae, in the middle portion of the test broken into irregular spines, and in the final chamber becoming obsolete; aperture with a cylindrical neck and slight, phialine lip. Length 0.30-0.35 mm.; breadth 0.15 mm.

The types are from the Eocene, Yegua formation, Claiborne, of Rio Bravo Oil Co., Deussen B 1, 4,010 ft., South Liberty Dome, Liberty Co., Tex.

This was first described without a figure as a variety of d'Orbigny's species from the Pliocene of Italy. The Texas form seems to be a distinct species, and is here figured and redescribed.

ANGULOGERINA PARVULA (Cushman and Thomas) (Pl. 12, fig. 19)

Uvigerina parvula CUSHMAN and THOMAS, Journ. Pal., vol. 3, 1929, p. 178, pl. 23, figs. 3, 4.

Test minute, elongate, 1½-2½ times as long as broad, fusiform, in the later portion triangular in cross-section, periphery lobulate; chambers numerous, distinct, somewhat inflated; sutures distinct, depressed; wall in the early portion ornamented with numerous, longitudinal costae, 20-25 in the complete circumference, in the adult becoming entirely smooth; aperture with a short, somewhat tapering neck, and a slight lip. Length 0.22-0.27 mm.; breadth 0.11-0.19 mm.

The types are from the Eocene, Cooks Mountain formation, 3 miles N. of Bronson, on Jasper-Tebo-San Augustine road, Sabine Co., Tex.

A study of the types shows this to belong under *Angulogerina*.

DOUBTFUL RECORDS

Uvigerina canariensis D'ORBIGNY. (W. Berry, Eclogae Geologicae Helvetiae, vol. 21, No. 1, 1928, p. 131; No. 2, 1928, p. 391.) Under this name Berry records specimens from the Restin shale and Lobitos shale from northwestern Peru. No specimens are available to us, and as no figures are given, these forms must remain doubtful.

Uvigerina farinosa HANTKEN. (Howe and Wallace, Louisiana Geol. Bull. No. 2, 1932, p. 63, pl. 12, fig. 4.) Specimens from the upper Eocene of Louisiana are referred to Hantken's species but were not found in the material available to us from the Danville locality.

Uvigerina mediterranea HOFKER. (Pijpers, Geol. Pal. Bonaire, 1933, p. 69.) Pijpers records this species from the upper Eocene of a well near Porta Spaño (Columbia Plantation), Bonaire, D. W. I., but gives no figures.

Uvigerina pigmea D'ORBIGNY. There are several records from the American Eocene under this name. Typical *U. pigmea* is, so far as we have seen, limited to the late Tertiary of the Mediterranean region, and the American Eocene specimens should be studied further.

RECENT LITERATURE ON THE FORAMINIFERA

Below are given some of the more recent works on the foraminifera that have come to hand.

Parr, Walter J. Tertiary Foraminifera from near Bombay, Franklin County, Auckland, New Zealand.—Trans. Roy. Soc. New Zealand, vol. 67, 1937, pp. 71-77, pl. 15.—Notes and figures several species, none new.

Bermudez, Pedro J. Nuevas especies de Foraminíferos del Eoceno de Cuba.—Mem. Soc. Cubana Hist. Nat., vol. XI, No. 3, July, 1937, pp. 137-150, pls. 16-19.—19 new species and 2 new varieties.

Notas sobre *Hantkenina brevispina* Cushman.—L. c., pp. 151, 152, pl. 19 (part).—Figures and redescribes the species, and a new subgenus *Sporohantkenina* proposed.

Estudio micropaleontológico de dos formaciones eocénicas de las cercanías de la Habana, Cuba.—L. c., pp. 153-180.—Notes on many species and tables of distribution.

Chawner, W. D. Geology of Catahoula and Concordia Parishes.—State of Louisiana, Dept. Conservation, Geol. Bull. No. 9, Dec., 1936, pp. I-XIII, 1-232, pls. IV-XV, text figs. 1-6, maps.—Many lists of foraminifera given.

Loetterle, Gerald J. The Micropaleontology of the Niobrara Formation in Kansas, Nebraska, and South Dakota.—Nebraska Geol. Survey, Ser. 2, Bull. 12, June, 1937, pp. 1-73, pls. I-XI, text figs. 1-3.—Describes and figures numerous foraminifera; 8 new species.

Coryell, H. N. and John R. Embich. The Tranquilla Shale (Upper Eocene) of Panama and its Foraminiferal Fauna.—Journ. Pal., vol. 11, 1937, pp. 289-305, pls. 41-43, text fig. 1.—Describe and figure 64 species and varieties, 26 new.

Albritton, Claude C., Jr. and Fred B. Phleger, Jr. Foraminiferal Zonation of Certain Upper Cretaceous Clays of Texas.—L. c., pp. 347-354, 3 text figs.—2 new species.

Durham, J. Wyatt. *Operculina* in the Lower Tertiary of Washington.—L. c., p. 366, 1 text fig.

Tan Sin Hok. Note on Miogypsina kotōi Hanzawa.—“De Ingenieur in Nederlandsch-Indië,” IV. Mijnbouw Geol., Jaarg. IV, No. 2, Feb., 1937, pp. 31, 32, 1 plate.

Weitere Untersuchungen über die Miogypsiniden I.—L. c., No. 3, March, 1937, pp. 35-45, pls. I-III.—1 new species, 1 new form; II.—L. c., No. 6, June, 1937, pp. 87-111, pls. I-IV.—1 new variety, 1 new form.

Rutten, M. G. Über Stolonen bei Lepidorbitoides socialis (Leymerie).—L. c., Jaarg. III, No. 5, May, 1936, pp. 82-84, text figs. 1, 2.

Zur Einführung geographischer Rassenkreise bei fossilen Foraminiferen. Antwort an Hans E. Thalmann.—Pal. Zeitschr., vol. 17, 1935, pp. 257-262.

On an interseptal Canal-system in the foraminiferal Species Discocyclina papyracea (Boubée).—Proc. Roy. Acad. Amsterdam, vol. XXXIX, 1936, pp. 413-418, pl. I, text figs. 1-7.

Voorwijk, G. H. Foraminifera from the upper cretaceous of Habana, Cuba.—L. c., vol. XL, No. 2, 1937, pp. 190-198, pl. III, 49 text figs.—2 new species.

Boomgaart, L. and J. Vroman. Smaller Foraminifera from the Marl Zone between Sonde and Modjokerto (Java).—L. c., vol. XXXIX, No. 3, 1936, pp. 421-425.—1 new species.

Hada, Yoshine. Studies on the Foraminifera of Brackish Waters. I, Hijirippu and Mochirippu Lakes.—Zool. Mag., vol. 48, Oct., 1936, pp. 847-860, text figs. 1-12.

Some new monothalamous Foraminifera from northern Japanese waters.—Trans. Sapporo Nat. Hist. Soc., vol. XIV, pt. 4, 1936, pp. 242-245, text figs. 1-5.—5 new species of *Lagena*.

Rutten, M. G. Geology of the Northern Part of the Province Santa Clara, Cuba.—Geogr. en Geol. Med., Utrecht, Physiogr.-Geol. Reeks, No. 11, 1936, pp. 1-59, 1 pl., 12 text figs., maps.

Thiadens, A. A. Geology of the Southern Part of the Province Santa Clara, Cuba.—L. c., No. 12, 1937, pp. 1-61, 1 pl., maps.

Vermunt, L. W. J. Geology of the Province of Pinar del Rio, Cuba.—L. c., No. 13, 1937, pp. 1-60, 1 pl., maps.

Colom, G. Estudios Litologicos sobre el Jurásico de Mallorca.—Géol. Méditerranée Occid., vol. 3, No. 4, pt. 5, Dec. 15, 1935, pp. 1-17, pls. I, II, text figs. 1-4.

Silvestri, A. Fossile eocenico singolare della Tripolitania.—Boll. Soc. Geol. Ital., vol. LVI, pt. 2, 1937, pp. 203-208, pl. IX.—*Operculina alpina* H. Douvillé, var. *multiseptata*, n. var.

Foraminiferi dell' Oligocene e del Miocene della Somalia.—Pal. Ital., vol. XXXII, Suppl. 2, 1937, pp. 43-264, pls. IV-XXII (I-XIX).—3 new species; 6 new varieties.

Rauser-Cernoussova, D. *Rugosofusulina*, a new Genus of Fusulinids.—Studies in Micropaleontology, Moscow Univ., vol. 1, fasc. 1, 1937, pp. 9-26, pls. I-III, 2 text figs.—*Rugosofusulina* n. gen.; 8 new species; 2 new varieties.

Glaessner, M. F. Planktonforaminiferen aus der Kreide und dem Eozän und ihre Stratigraphische Bedeutung.—L. c., pp. 27-52, 2 pls., 6 text figs.—2 new species; 3 new varieties.

Das Vorkommen von *Siderolites vidali* Douv. und *Arnaudiella grossouvrei* Douv. im Kaukasus.—L. c., pp. 53-56.

Studien ueber Foraminiferen aus der Kreide und dem Tertiaer des Kaukasus. I. Die Foraminiferen der aeltesten Tertiaerschichten des Nordwestkaukasus.—Problems of Paleontology, Moscow Univ., vols. II-III, 1937, pp. 349-410, pls. I-IV.—5 new species; 2 new varieties.

Die Entfaltung der Foraminiferenfamilie Buliminidae.—L. c., pp. 411-423, 2 text figs.

Cushman, JosephA. A Monograph of the Foraminiferal Family Verneuilinidae.—Special Publ. No. 7, Cushman Lab. Foram Res., April, 1937, pp. i-xiii, 1-157, pls. 1-20.

A Monograph of the Foraminiferal Family Valvulinidae.—L. c., No. 8, June, 1937, pp. i-xiii, 1-210, pls. 1-24.

A Monograph of the Subfamily Virgulininae of the Foraminiferal Family Buliminidae.—L. c., No. 9, pp. i-xv, 1-228, pls. 1-24.

J. A. C.

FORAMINIFERA

Their Classification and Economic Use

Second Edition

AN ILLUSTRATED KEY TO THE GENERA OF THE FORAMINIFERA

by JOSEPH A. CUSHMAN

Lecturer in Micropalaontology, Harvard University

The two volumes, cloth bound, with 426 pages and 71 plates sent on receipt of price, \$5 express paid in U. S. A.; \$6 postpaid, Foreign.

Special Publ. No. 7. A Monograph of the Foraminiferal Family Verneuilinidae. 170 pages and 20 plates....\$3.50

Special Publ. No. 8. A Monograph of the Foraminiferal Family Valvulinidae. 210 pages and 24 plates....\$4.00

Special Publ. No. 9. A Monograph of the Subfamily Virgininae. 240 pages and 24 plates.....\$4.00

SPECIAL OFFER:

Nos. 7—9 inc. until January 1, 1938 sent on receipt of \$10.00

Price list of available foraminiferal literature sent on request.

Topotypes of many species available: 50c per slide.

CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

SHARON, MASS., U. S. A.

CHECK LIST OF AMERICAN CRETACEOUS FORAMINIFERA

by LOIS T. MARTIN

Geographic and geologic distribution of 875 species, with accompanying bibliography, and indices to genera, species, and synonymy.

Available after September 1, 1936, at \$4.50 a copy, by subscription. Price after copies mailed to subscribers will be \$5.50. Make checks payable to LOIS T. MARTIN, Stanford University, California.

